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New Journal Available at Hamilton Library on Mānoa Campus of UH 15

Decline of Invasive Faya in Hawai'i

Brion K. Duffy and Donald E. Gardner

Cooperative Park Studies Unit, National Park Service, Department of Botany, University of Hawai'i at Mānoa, Honolulu, Hawai'i 96822

Pathogens and other problems encountered in new habitats often impede successful establishment of introduced species. Attention is usually focused on economically important examples in agriculture, such as Macadamia quick decline. We are interested in a recently observed, spontaneous decline of faya (*Myrica faya*), an introduced weed threatening native ecosystems in Hawai'i, for its potential applications in biological control.

Symptoms & Range

Faya decline is characterized by chronic defoliation (usually but not always beginning from the base), general and extensive chlorosis, and occasionally flagging (chlorosis or death of

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Published by the Hawaiian Botanical Society, which was founded in 1924 to "advance the science of botany in all its applications, encourage research in botany in all its phases, promote the welfare of its members and develop the spirit of good fellowship and cooperation among them." Any person interested in the plant life of the Hawaiian Islands is eligible for membership. Information may be obtained from the Society:

c/o Department of Botany
3190 Maile Way
University of Hawai'i
Honolulu, HI 96822

Membership

The Society year is from December 1 through November 30.

Membership	Cost per Year
Regular	$7.50
Student	$4.00
Family	$10.00
Life (individuals only)	$150.00

Honorary and Life Members pay no further dues.

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individual main branches one at a time). Decline is often rapid resulting in death of mature trees within approximately 2 years. Resprouting from the bases of dead branches was sporadic but never appeared to be successful. Trees in all stages of decline, including dead trees, were observed on the Big Island at ʻĀinahou and Hilina Pali in Hawaiʻi Volcanoes National Park (HAVO), Volcano Dump, Volcano Village, and between HAVO Headquarters and Volcano Golf Course (VGC) on Hwy. 11. Severely defoliated saplings estimated to be <5 years old were observed in VGC subdivision.

Pathogens & Insects

Fungal pathogens appear to have, at most, a limited involvement in decline. Dead trees at Hilina Pali are often infested with black fruiting bodies of *Hypoxylon moriforme*, but it is also common on otherwise healthy trees near Byron Ledge after felling. Armillaria root rot, which attacks weakened older trees in the area of origin for faya, was not observed on faya in Hawaiʻi although the fungus attacks other species in the state. Phytophthora root rot, a common contributing factor in tree decline, was also not found on faya. Roots of partially excavated faya in decline appeared healthy. Blackening of roots and actinorrhizal-nodules that was commonly observed appears normal and may likely result from a mycorrhizal association. Nine genera of plant-parasitic nematodes were collected from soil around faya roots but none were consistently associated in high numbers with decline. Mycoplasma-like organisms (MLOs) were not detected in declining faya, however, these often occur in low titre in woody hosts and may easily have escaped detection by the DAPI staining methods used. The involvement of MLOs or virus-like pathogens in other plant diseases in Hawaiʻi (Borth et al. 1990; 1992; 1994) justifies continued investigation, possibly using a combination of detection methods.

Several insects were observed attacking faya in Hawaiʻi. Fruit and foliar feeders recently described by Duffy & Gardner (1994) are not considered factors in decline. Two

wood borers (one black in dead faya at Hilina Pali and another one brown in declining faya at Volcano Dump) may contribute to decline but are not considered primary causes because of their infrequent occurrence. The leafhopper, *Siphonia rufofascia* (syn. *Pseudonirvana rufofascia*) was widely observed on faya throughout Hawai'i. The involvement of this leafhopper in widespread dieback of uluhe and other species (Vince Jones, *personal communication*], and the coincidence of its recent introduction into Hawai'i with the advent of faya decline justifies further investigation.

Abiotic Factors

Soil and tissue analysis revealed no correlation between decline and any of 14 chemical properties considered. While water stress cannot be discounted as a possible contributing factor, this appears unlikely since 1) decline sites occur across a gradient of rainfalls from very wet to moderately dry, 2) both 'Āinahou and Hilina Pali have had above average rainfall the last 4 years while decline has progressed, 3) faya appears to be relatively drought tolerant as compared with other species (Lipp 1994). Cohort senescence is also an unlikely explanation since 1) trees in decline are mature but relatively young compared to trees at other sites, 2) decline has not been documented from faya's native habitat. (The few trees in decline we have observed there were usually decrepit and suffering from Armillaria root rot. Anecdotal reports of more widespread decline in Macaronesia may have been confused with decline of aceviño [*Ilex canariensis*], which occupies the same ecological niche and resembles faya from a distance.) It may be possible, however, that decline sites in Hawai'i represent the range limit of faya rendering it more susceptible to otherwise tolerable disturbances or that differential sensitivity between populations is based on slight genetic variation.

Conclusions

Faya decline may have important implications for weed control justifying further study. Adoption of a multidisciplinary approach is encouraged to expedite elucidation of faya decline etiology and to limit

the impediments to progress experienced in investigations of other forest decline problems in Hawai'i. Longterm study will be essential to characterize nonpathogenic environmental/ecological factors possibly contributing to decline. Transmissibility experiments may be useful to further evaluate the contribution of pathogens and assess the potential for exploitation of decline in biocontrol. Investigation of the newly introduced leafhopper and involvment of fastidious pathogens such as MLOs and virus-like agents is recommended.

We gratefully acknowledge the support of W. Borth, G. Cran, J. Fujii, D. Hemlmes, R Ley, D. Schmitt, C. Smith, Q. Tomich, and HAVO personnel, particularly D. Foote, R Loh, E. Richardson, D. Taylor, and T. Tunison.

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Native Ecosystem Regeneration Project Celebrates its First Anniversary

Deborah Ward
County Extension Agent UH Mānoa,
College of Tropical Agriculture &
Human Resources

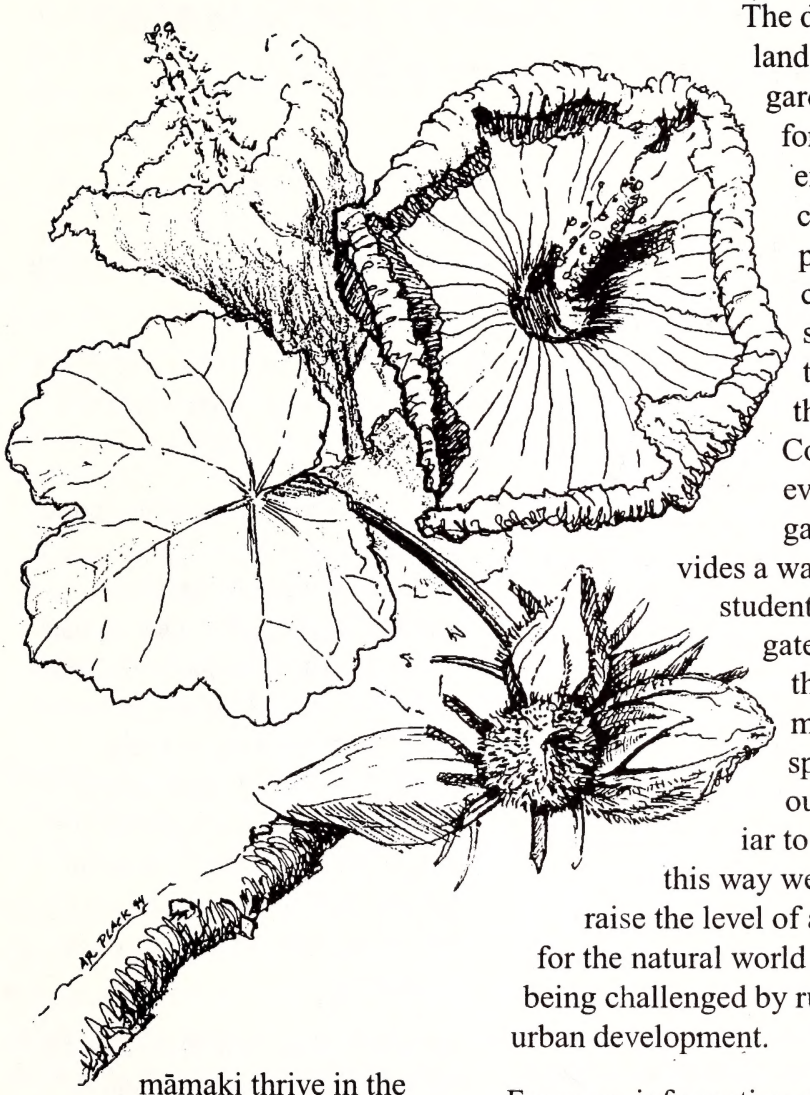
(Illustration by Andrew R. Plack)

Education of the public about the ecological, cultural and intrinsic value of native species can help us gain allies when it comes to the issue of prime importance; the protection of intact native ecosystems. Botanical gardens, situated in public places and cared for by members of the community can offer an excellent outdoor classroom for public education.

Hawai'i Community College recently saluted biologists Fred Stone and Lani Stemmermann with an Inovation Award for establishing a campus garden, which features working models of organic raised-bed gardening, permaculture and native ecosystem regeneration.

The native ecosystem regeneration project began only a year ago, on a half-acre site that was formerly rock, weed trees and head-high grass. Brandishing a machete and a bladed weed-eater, Fred Stone cut vegetation flat, laid several layers of cardboard down to discourage regrowth, followed by six inches of "winter mulch" — material washed onto the shore of Hilo Bay during heavy winter rains. Through holes poked in these materials, Fred planted propagules of plant material rescued from nearby construction sites, such as the area recently razed for the parking lot at Prince Kūhiō Plaza.

Today, the garden features 25 endemic and indigenous Hawaiian plants from lowland strand, rainforest and mesic areas of East Hawai'i. Ma'o hau hele (*Hibiscus brackenridgei*) [illustrated], Hawaii's state flower, will bloom for the first time in February. Naupaka (*Scaevola sericea*) has filled in the front border, and shelters nanea, hala, kou, milo, 'akia and 'ihi'ihi, pōhinahina and pōhuehue. 'Ōhi'a, hāpu'u, 'am'uma'u, kōlea, maile, loulu and



māmaki thrive in the regenerating forest, sheltered by the remaining weedy *Melochia*. On the rocky, sunny outcrop grow lowland koa, ʻuki, hoʻawa, olopua, ʻalaheʻe, ʻuʻulei and mamane.

The dynamic landscape of the garden is used for biology and environmental classes, youth programs and community seminars throughout the year. Constantly evolving, the garden provides a way for many students to propagate and observe the growth of many native species previously unfamiliar to them. In this way we hope to raise the level of appreciation for the natural world so rapidly being challenged by rural and urban development.

For more information about the garden, call Dr. Fred Stone at 933-3421, or Deborah Ward at 959-9155

Update on Critical Habitat for Hawaiian Threatened and Endangered Plants

Camille Barr

Under Section 4 of the Endangered Species Act (ESA), critical habitat must be designated for all species at the time of listing. Critical habitat is defined as those areas that are "essential for the conservation of the species," in effect, necessary for the species' full recovery which is the goal of the ESA. The Hawaiian Botanical Society, Sierra Club, and Conservation Council for Hawai'i were successful in settling out-of-court in 1990 with the U.S. Fish and Wildlife Service to list 187 species of threatened or endangered plants, most of which had been languishing on candidate lists for years. FWS, however, has refused to designate or even consider designating critical habitat for these species making a blanket claim that this designation in "not prudent" and would threaten each of their existence by making them available for vandals and overzealous collectors. A working group has been put together by the Sierra Club Legal Defense Fund to challenge this assumption, with the understanding that:

1) the situation in Hawai'i does not represent the mainland when it comes to endangered species;

2) critical habitat designation could greatly benefit some species such as for providing habitat for outplanting (e.g. for species that are now extirpated from the wild and exist only in botanical gardens, protection of these species' habitat is nonexistent and could lead to situations in which we have many plants in gardens but nowhere suitable to put them, making full recovery impossible;

3) designation of critical and essential habitat (essential habitat is those areas which the species currently occupies and is essential to the species' immediate survival) might become much more valuable and needed if

DLNR is successful in implementing and "incidental take" provision in Hawai'i state endangered plant laws;

4) critical habitat adds another trigger for federal agencies to consult with the FWS under section 7 of the ESA when their actions threaten listed species (federal agencies in Hawai'i have been very inattentive to their legal responsibility to consult with the FWS, evidenced by the fact that no formal consultations have been initiated for the 187 new species despite the reality that federal agency activity has not decreased); and

5) maps and information detailing the locations of these species are already available to the public.

The working group consists of Camille Barr representing the Botanical Society; Benton Pang and James Kwon, both members of the Botanical Society; Steve Montgomery of the Conservation Council for Hawai'i; Andy Cowell of the Hawai'i Audubon Society; and Marjorie Ziegler of the Sierra Club Legal Defense Fund.

In March of this year, a meeting was held between the working group and the three officials of the FWS: Robert Smith, Ecoregion Manager of the Pacific Region; John Doebel, Assistant Regional Director for Refuges and Wildlife for the Pacific Region; and Thomas Dwyer, Deputy Regional Director for the Pacific Region. Thomas Dwyer questioned Robert Smith's blanket conviction that vandalism would result from critical habitat designation for all species, and agreed to look into the FWS's policy and consider the possibility that some plants might benefit from designation. While these steps are preliminary, they represent a potential move toward progress, especially considering the current political climate. If the FWS continues to assert that *not one* of our Hawaiian plants could benefit from designation, a 60-day notice for litigation could be the most effective move for ensuring protection of our flora, especially those plants threatened by federal agency actions. If that becomes necessary, a vote will be brought up to membership of the Botanical Society to take part in that action.

Notes for the Hawaiian Botanical Society

November

President Keeley called the November 11th meeting to order at 7:30 p.m. The minutes were read and accepted. The treasurer's report was postponed to December. Membership Committee proposed four new members: Kendra Ann Mingo, Priscilla Millen, , Jonell Smith, and Gary Ray. All were accepted into the Society. New members for May 1994 were added to the minutes. Don Gowing also mentioned the passing of two members, Charles Crispin and Clifton Davis.

New Business

Nominating committee presented their slate of officers for 1995 — President — Camille Barr, graduate student in botany; Vice President — Lisa Stratton, graduate student in botany; Secretary — Leilani Pyle; Treasurer — Ron Fenstenmacher; Board of Directors — Alvin Chock and Alvin Yoshinaga.

Editor Greg Koob reminded the members to donate $3.00 to help defray costs for publication of the Special Newsletter. Secretary Pang announced that FWS recovery plans, and endangered species proposals were available for review.

Dave Web of the botany department at UH talked on his identification of a Hawaiian sandal at the Bishop Museum. After anatomical studies of various plants he found that fibers from the introduced Mauritius hemp *(Furcraea foetida)* was used to make this particular sandal. Orlo Steele of the botany department at UH spoke about his internship to the Guianas. He showed slides of his field work, the places he and colleagues collected from and especially the people who were vital to his collection activities. His slides highlighted the many interesting plants that were collected for the Smithsonian Institution.

December

President Keeley called the December meeting to order at 7:30 p.m. The minutes of November were read and accepted. There was no treasurer's report. Membership Committee proposed two new

members: Camille Barr and Calvin Harada. Both were accepted into the Society.

New Business.

Don Gowing announced that copies of *Allertonia* and *Flora Vitiensis* were available at a 50% discount from Foster Gardens. Don Gowing, membership chair, certified there was membership quorum for the voting of new officers. Hearing no new nomination from the floor, Secretary Pang caste a unanimous ballot. The new board of officers for 1995 are: **President** — Camille Barr, graduate student in botany; **Vice-President** — Lisa Stratton, graduate student in botany; **Secretary** — Leilani Pyle, Bishop Museum; **Treasurer** — Ron Fenstemacher, Ho'okahe Wai Ho'olu'ina; **Board of Directors** — Alvin Chock and Alvin Yoshinaga.

Vice-President Lisa Stratton announced Marie Bruegeman of the US Fish and Wildlife Service as the plant of the month speaker. Marie showed the one clump of *Mariscus pinnatiformis* ssp. *bryanii* left on Laysan Island. The habitat of this endemic sedge has been reduced due to rabbits introduced in the 1920s. Currently 11 plants are growing at Lyon Arboretum and it has proposed as an endangered species. Patti Welton of Haleakala National Park was the speaker of the month. She showed slides from her recent trip to Madagascar. Her slides illustrated the numerous species endemic to Madagascar, and the national parks which protect them. Refreshments were served afterward.

January

The meeting was called to order by President Camille Barr at 7:40 p.m. She asked if there were any visitors to be introduced. Linn and Margaret Bogel and Vince Kline, all from New Hampshire, introduced themselves.

Minutes from the December meeting were read by Benton Pang and accepted.

Treasurer Ron Fenstemacher gave an annual treasurer's report. Ron thanked Dan and Helen Palmer for the thorough audit of the 1991, 1992, and 1993 reports. He also pointed out that if it had not been for donation in 1994 of $161.00 and three life memberships amounting

to $450, our Society would be in the red for 1994. Ron suggested that the society put out a botanical field guide, as an income maker. Hawaii Audubon Society receives part of their income from their publication Hawaii's Birds. The treasurer then asked for a volunteer to audit the 1994 treasurer's report and Loyal Mehrhoff volunteered.

The president announced that Don Gowing would like to step down as Membership Chairman, and Alvin Yoshinaga has agreed to take his place.

New Business

The president suggested we have a membership drive as we need more income and our membership total is down to about 158 members. She asked that members ask their friends to join and February will be membership month, with prizes to the person who brings in the most members. Membership forms and membership lists will be available at the February meeting.

Benton Pang introduced Ellen Sofia, graduate student at the UH medical school, who requested to speak to our society members about construction of a new snack bar in the park area in front of Hamilton Library, across the street from St. John Hall.

Lisa Stratton introduced both our speakers, Loyal Mehrhoff from the US Fish and Wildlife Service for the plant of the month and our main speaker, Betsy Gagné from the Natural Area Reserves System.

Loyal's plant of the month, *Nesogenes rotensis*, is a species of the Verbenaceae. Derral Herbst discovered this species in 1982 on Rota, and island in the Marianas Group in Micronesia. In a recent USFWS survey there were 15 to 20 plants of this prostrate plant growing over a raised limestone shelf. It is now under consideration as a candidate for the US Endangered Species list. Eight seeds were brought to Greg Koob for propagation but were not viable. The pollinators are unknown.

The main speaker, Betsy Gagné, Executive Secretary for the Natural Area Reserves System Commission, Department of Land and Natural Resources, spoke and showed slides on the NARS system.

In the early 1970s the biologists and others realized the importance of focusing on saving entire ecosystems rather than focusing on individual species and out of that came the idea to set up a system of reserves on the best natural areas left on State land which currently amounts to 110,000 acres. She told us of the Reserves, which now number 19, beginning with the first, Ahihi-Kinau, which is significant for its anchialine pools and marine life. The are also contains the last known flow from Haleakala.

Maui Native Plant Society
1995 Work Party Schedule

Help take care of Maui's native plants and ecosystems. The following is the work party schedule for the remainder of 1995. Meet at 8:00 a.m. on the second Saturday of the month. Bring lunch, tools, water, gloves, sunscreen and raingear. Call the Project Leader for detailed information on each activity.

May: *Hibiscus brackenridgei* Exclosure
Call Richard (877-4024)

June: Gressitt Sanctuary
Call Linda (661-4303)

July: La Perouse Exclosure
Call Richard (877-4024)

August: Auwahi Exclosures
Call Richard (877-4024)

September: *Hibiscus brackenridgei* Exclosure
Call Richard (877-4024)

October: Gressitt Sanctuary
Call Linda (661-4303)

November: Kanaha Pond Wildlife Sanctuary
Call Project Leader Eda Kinnear (871-4891)
also Tuesday and Saturdays, 8:30-11:00 a.m., call Mike (572-9836)

December: Auwahi Exclosures
Call Richard (877-4024)

Treasurer's Report

January 1994 to December 1994

The Society's bank, Honfed, was acquired by the Bank of America in 1994 and the Botanical Society's account has changed. New checks and a new account will be used from January 1995. The Treasurer would like to thank Dan and especially Helen Palmer for the thorough financial audit of the Society's books for 1991, 1992, and 1993. Presented below is a summary of receipts and expenses for 1994:

Income		Outgo	
Dues	$1469.00	Copying	$1022.26
Special Newsletter	$291.00	Postage	$563.81
Donations	$161.00	Science Fair	$240.00
Plant Sale	$139.00	Monthly Refreshments	$70.97
Interest	$70.92	Paradise Pursuit	$50.00
Poster Sale	$13.50	Stationery	$42.76
	$2144.42		**$1989.80**

Beginning Balance + Income - Outgo = Ending Balance

$4450.46 + $2144.42 - $1989.80 = $4605.08

Total gain for 1994 is $154.62

Respectfully submitted

Ron Fenstemacher,
Treasurer

1994 Dues Summary:

Student	15 x 1 yr	$60.00
	1 x 2 yr	$8.00
Individual	67 x 1 yr	$502.50
	4 x 2 yr	$60.00
Institutional	13 x 1 yr	$97.50
Family	27 x 1 yr	$270.00
	1 x 2 yr	$20.00
Life	3	$450.00
Adjustment (from 1993)		$1.00
		$1469.00

New Journal Avalable at Hamilton Library on Mānoa Capus of UH

Novon, a journal for botanical nomenclature from the Missouri Botanical Garden is now available at Hamilton Library. It is published quarterly and contains papers whose purpose is the establishment of new nomenclature in vacsular plants and bryophytes. This relatively new journal is included in the subscription price of the *Annals of the Missouri Botanical Garden.* It can be found on the shelves where new issues of journals are displayed, it is not on the regular shelves, yet. There have been several articles pertaining to Hawaiian plants in recent issues.

Become a Member, or Recruit a Friend

The Hawaiian Botanical Society was founded in 1924 to "advance the science of botany in all its applications, encourage research in botany in all its phases" and to "promote the welfare of its members and to develop the spirit of good fellowship and cooperation among them."

Dues are as follows, please fill out below and send with payment to the address on the back of this page:

☐	**Regular**	$7.50
☐	**Student**	$4.00 (please indicate school)
☐	**Family**	$10.00
☐	**Life** (indivduals only)	$150.00

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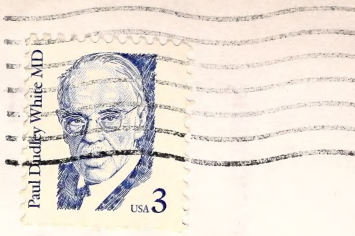

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